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Ecological Classification of Riparian and Non-Forested Communities in the Black Hills

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FINAL REPORT

ECOLOGICAL CLASSIFICATION OF RIPARIAN AND NON-FORESTED COMMUNITIES IN THE BLACK HILLS

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by
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Methods

Data Collection

Data were collected by the Black Hills National Forest during the period of 1987-1992. Details for sampling protocol can be obtained from the Black Hills National Forest, Custer, South Dakota. Based on field notes and collected data, a list of plant species and associated ocular estimates of percent canopy cover for herbaceous, shrubs, and trees was developed for the Black Hills and Bear Lodge Mountains of South Dakota and Wyoming. A reconnaissance of the major drainageways was conducted before stands were selected for sampling. Sites selected for ecological type classification were considered near their biological potential and have been exposed to various levels of natural and management disturbance. Sampling within stands was completed by methods described by Mueller-Dambois and Ellenberg (1974). This is a semi-quantitative sampling procedure because of broad ocular estimation of canopy cover and the large intervals among the scale values. A minimum of 3 plots per ecological and community type was sampled.

Data Analyses

Classification into ecological/community types was based on floristic attributes (percent canopy cover). Data from a total of 256 plots was subjected to a data reduction procedure (SAS Institute 1988). Clustering technique using ISODATA (Ball and Hall 1967) was applied to separate the ecological and community types based on variables (40 plant species) that account for most of the variation among the 256 sites. A tree classification procedure using CART analysis (Breiman et al. 1984) was then applied to confirm cluster analysis results and to develop a classification key. This classification key is a field tool to identify existing

ecological community types. In addition, tables of association for each ecological/community type were completed to help substantiate the classification results.

Application

Two classification keys were developed, one for riparian plant communities and the other for non-forested upland plant communities. For field identification of plant communities, the classification keys are to be used as follows:

Riparian Plant Communities

The classification key is based on a presence-absence elimination procedure (see classification key diagram). For instance, if sandbar willow is absent or present with less than 15% canopy cover, move down the tree following the "No" arrow to the next diamond-shaped box. Check this box for Broad-leaved cat tail. If Sandbar willow is present with more than 15% canopy cover, follow the "Yes" arrow which assigns the plant association to "Sandbar willow/Bebb willow". Additional information can be obtained from the association tables and accompanying descriptions to verify the classification results. If there is no assigned community type, the site being classified may be outside the range of this classification key. The last box has Aquatic sedge/bluejoint/beaked sedge.

Non-Forested Upland Plant Communities

This classification key is based on a presence-absence elimination procedure (see classification key diagram). For instance, if Big bluestem is absent from the site or present with less than 5% canopy cover, move down the tree following the "No" arrow to the next diamond-shaped box. Check this box for Thimothy. If Big bluestem is present with more than 5% canopy cover, follow the "Yes" arrow which assigns the plant association to "Big bluestem/Lead plant".

Additional information can be obtained from the association table and accompanying description to verify the classification results. If you reach the last box and there is no assigned community type, the site being classified may be outside the range of this classification key. The last box has Kentucky bluegrass/Common yarrow.

Conclusion

This classification key can only be used to identify plant communities in the Black Hills. Its use for monitoring purposes is not recommended because sampling of plant attributes within macroplots was subject to bias from ocular estimation of canopy cover. In addition, variation among observers may be larger than variation within vegetation stands. Therefore, monitoring changes within a plant community with the classification key may yields crude results.

References

Ball, G. H. and D. J. Hall. 1967. A clustering technique for summarizing multivariate data. Behavioral Sci. 12: 153-155.

Breiman, L., J. Friedman, R. Olshen, and C. Stone. 1984. Classification and regression tree. Pacific Grove: Wadsworth, 1984.

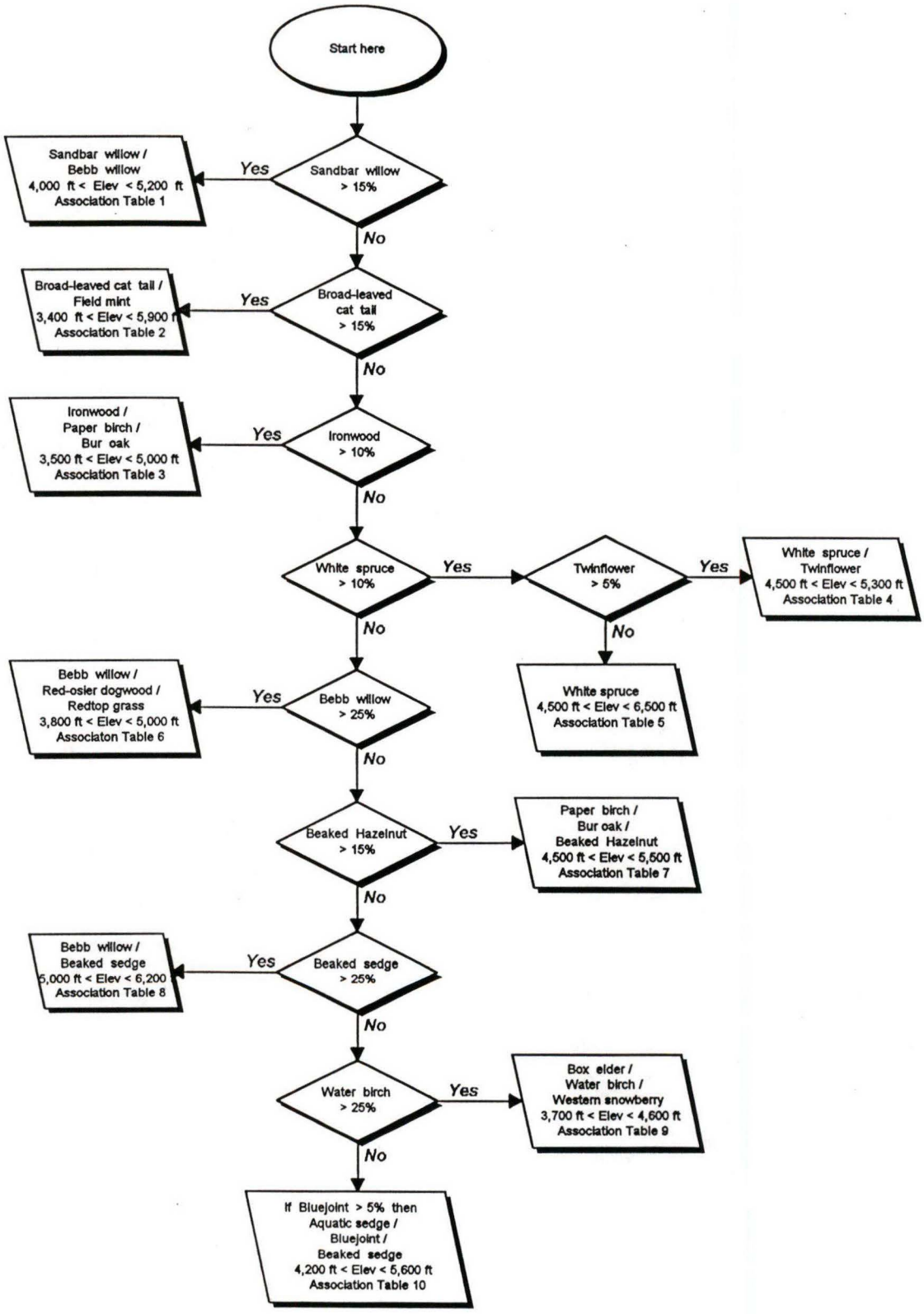
Muller-Dombois, D. and H. Ellenberg. 1974. Aims and methods of vegetation Ecology.John Wiley & Sons, Inc. New York. 547 p.

Sas Institute, Inc. 1990. SAS/STAT User's guide. SAS Institute Inc. SAS Campus Drive, Cary, N C. 890 p.

BLACK HILLS RIPARIAN PLANT ASSOCIATIONS

Code		Number of Sites
Sabe2/Cost4-Agst2	*Salix bebbiana/Cornus stolonifera-Agrostis stolonifera* Bebb willow/Red-osier dogwood-Redtop grass	*7*
Saex/Sabe2-Popr	*Salix exigua/Salix bebbiana-Poa pratensis* Sandbar willow/Bebb willow-Kentucky bluegrass	*10*
Osvi/Bepa-Quma2	*Ostrya virginiana/Betula papyrifera-Quercus macrocarpa* Ironwood/Paper birch-Bur oak	*14*
Bepa/Quma2-Coco6	*Betula papyrifera/Quercus macrocarpa-Corylus cornuta* Paper birch/Bur oak-Beaked hazelnut	*21*
Acne2/Beoc2-Syoc	*Acer negundo/Betula occidentalis-Symphoricarpos occidentalis* Box elder/Water birch-Western snowberry	*8*
Pigl/Libo3	*Picea glauca/Linnea borealis* White spruce/Twinflower	*6*
Pigl	*Picea glauca* White spruce	*24*
Sabe2/Caro6	*Salix bebbiana/Carex rostrata* Bebb willow/Beaked sedge	*17*
Caaq/Caca4-Caro6	*Carex aquatilis/Calamagrostis canadensis-Carex rostrata* Aquatic sedge/Bluejoint reedgrass-Beaked sedge	*9*
Carex	*Carex spp.* (we want to delete this type because it is undefinable) Sedge or sedges	*10*
Tyla/Mear4	*Typha latifolia/Mentha arvensis* Broad-leaved cat tail/Field mint	*9*

Black Hills Riparian Vegetation Classification Key



Saex/Sabe2-Popr
Sandbar willow/Bebb willow-Kentucky bluegrass

Table 1.--Canopy cover and constancy estimates for dominant plant species recorded in *Salix exigua/Salix bebbiana-Poa pratensis* association, occurring in the Black Hills at an average altitude ranging from 4,000 to 5,200 ft (number = 10 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
POTR5	*Populus tremuloides*	10.00	10.00	10.00	10.00
Shrubs					
COSE16	*Cornus sericea*	3.75	2.50	5.00	20.00
RUID	*Rubus idaeus*	16.38	.50	40.00	40.00
SABE2	*Salix bebbiana*	4.83	.50	10.00	60.00
SAER	*Salix eriocephala*	20.00	20.00	20.00	10.00
SAEX	*Salix exigua*	50.00	30.00	90.00	100.00
SAIN3	*Salix interior*	30.00	30.00	30.00	10.00
SALU	*Salix lucida*	2.50	2.50	2.50	10.00
SALU2	*Salix lutea*	3.00	3.00	3.00	10.00
Graminoids					
BRIN2	*Bromus inermis*	5.25	.50	10.00	20.00
CAAQ	*Carex aquatilis*	6.00	.50	15.00	30.00
CACA4	*Calamagrostis canadensis*	10.00	5.00	15.00	20.00
POPR	*Poa pratensis*	14.94	.50	60.00	80.00
EQAR	*Equisetum arvense*	14.50	.50	60.00	60.00
Forbs					
GLLE3	*Glycyrrhiza lepidota*	8.67	3.00	20.00	30.00
LYCI	*Lysimachia ciliata*	5.67	.50	20.00	60.00
RULA3	*Rudbeckia laciniata*	6.83	.50	10.00	30.00

Tyla/Mear4

Broad-leave cat tail/Field mint

Table 2.--Canopy cover and constancy estimates for dominant plant species recorded in *Typha latifolia/Mentha arvensis* association, occurring in the Black Hills at an average altitude ranging from 3,400 to 5,900 ft (number = 9 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Shrubs					
SABE2	*Salix bebbiana*	1.75	.50	3.00	22.22
Graminoids					
CACA4	*Calamagrostis canadensis*	2.75	.50	5.00	22.22
CARO6	*Carex rostrata*	7.40	.50	30.00	55.56
GLGR	*Glyceria grandis*	1.75	.50	3.00	44.44
JUNO2	*Juncus nodosus*	1.75	.50	3.00	22.22
TYLA	*Typha latifolia*	52.22	30.00	90.00	100.00
Forbs					
EPAD	*Epilobium adenocaulon*	18.20	.50	40.00	55.56
LYAM	*Lycopus americanus*	1.50	.50	3.00	55.56
MEAR4	*Mentha arvensis*	3.75	.50	10.00	88.89
SCGA	*Scutellaria galericulata*	3.57	.50	10.00	77.78
URDI	*Urtica dioica*	1.75	.50	3.00	44.44

Osvi/Bepa-Quma2

Ironwood/Paper birch-Bur oak

Table 3.--Canopy cover and constancy estimates for dominant plant species recorded in *Ostrya virginiana/Betula papyrifera-Quercus macrocarpa* association, occurring in the Black Hills at an average altitude ranging from 3,800 to 5,000 ft (number = 14 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
BEPA	*Betula papyrifera*	22.17	3.00	70.00	85.71
OSVI	*Ostrya virginiana*	40.00	20.00	80.00	100.00
PIPO	*Pinus ponderosa*	2.00	.50	10.00	57.14
QUMA2	*Quercus macrocarpa*	10.61	.50	30.00	100.00
Shrubs					
MARE11	*Mahonia repens*	4.13	.50	10.00	28.57
SYOC	*Symphoricarpos occidentalis*	6.50	3.00	10.00	71.43
Graminoids					
CASP7	*Carex sprengelii*	4.13	.50	10.00	28.57
ORAS	*Oryzopsis asperifolia*	2.63	.50	10.00	57.14
POPR	*Poa pratensis*	5.35	.50	20.00	71.43
Forbs					
ARNU2	*Aralia nudicaulis*	4.75	.50	20.00	85.71
MACA4	*Maianthemum canadense*	2.42	.50	3.00	92.86
TORY	*Toxicodendron rydbergii*	9.67	.50	20.00	64.29

Pigl

White spruce

Table 4.--Canopy cover and constancy estimates for dominant plant species recorded in *Picea glauca* association, occurring in the Black Hills at an average altitude ranging from 4,500 to 6,500 ft (number = 24 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
BEPA	*Betula papyrifera*	7.33	3.00	20.00	25.00
PIGL	*Picea glauca*	37.93	8.50	80.00	100.00
PIPO	*Pinus ponderosa*	8.30	.50	30.00	20.83
POTR5	*Populus tremuloides*	10.57	.50	30.00	29.17
Shrubs					
BEOC2	*Betula occidentalis*	4.78	.50	20.00	37.50
COCO6	*Corylus cornuta*	6.50	.50	20.00	33.33
COST4	*Cornus stolonifera*	4.64	.50	20.00	58.33
PRVI	*Prunus virginiana*	5.39	.50	20.00	37.50
ROWO	*Rosa woodsii*	4.24	.50	20.00	70.83
SYOC	*Symphoricarpos occidentalis*	9.18	.50	30.00	45.83
Graminoids					
BRIN2	*Bromus inermis*	4.92	.50	10.00	25.00
CADE9	*Carex deweyana*	6.90	.50	30.00	20.83
CANE2	*Carex nebrascensis*	4.50	.50	10.00	12.50
CARO6	*Carex rostrata*	20.00	20.00	20.00	8.33
Forbs					
ACRU2	*Actaea rubra*	2.54	.50	20.00	50.00
ARNU2	*Aralia nudicaulis*	9.27	.50	30.00	54.17
FRVI	*Fragaria virginiana*	2.91	.50	10.00	45.83
VICA4	*Viola canadensis*	6.70	.50	50.00	41.67

Pigl/Libo3

White spruce/Twinflower

Table 5.--Canopy cover and constancy estimates for dominant plant species recorded in *Picea glauca/Linnea borealis* association, occurring in the Black Hills at an average altitude ranging from 4,600 to 5,300 ft (number = 6 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
LIBO3	*Linnaea borealis*	21.67	10.00	40.00	100.00
PIGL	*Picea glauca*	46.67	20.00	80.00	100.00
PIPO	*Pinus ponderosa*	10.33	.50	30.00	50.00
POTR5	*Populus tremuloides*	16.50	3.00	30.00	33.33
Shrubs					
COCO6	*Corylus cornuta*	26.67	20.00	40.00	50.00
COST4	*Cornus stolonifera*	7.20	3.00	10.00	83.33
JUCO6	*Juniperus communis*	3.67	.50	10.00	50.00
PRVI	*Prunus virginiana*	2.90	.50	10.00	83.33
ROWO	*Rosa woodsii*	3.33	.50	10.00	100.00
Graminoids					
CAREX	*Carex*	3.50	.50	10.00	66.67
ORAS	*Oryzopsis asperifolia*	2.00	.50	3.00	83.33
POPR	*Poa pratensis*	2.88	.50	10.00	66.67
Forbs					
ARNU2	*Aralia nudicaulis*	7.80	3.00	20.00	83.33
GATR3	*Galium triflorum*	2.08	.50	10.00	100.00
MACA4	*Maianthemum canadense*	6.63	.50	20.00	66.67

Sabe2/Cost4-Agst2
Bebb willow/Red-osier dog wood-Redtop grass

Table 6.--Canopy cover and constancy estimates for dominant plant species recorded in *Salix bebbiana/Cornus stolonifera-Agrostis stolonifera* association, occurring in the Black Hills at an average altitude ranging from 4,200 to 5,600 ft (number = 7 stands).

		Canopy Cover (%)			
		Mean	**Min**	**Max**	**Cons**
Trees					
PIGL	*Picea glauca*	2.08	.50	3.00	42.86
PIPO	*Pinus ponderosa*	2.08	.50	3.00	42.86
POTR5	*Populus tremuloides*	6.83	.50	10.00	42.86
PODE3	*Populus deltoides*	30.00	20.00	40.00	28.57
SAAM2	*Salix amygdaloides*	20.00	20.00	20.00	14.29
Shrubs					
SABE2	*Salix bebbiana*	35.71	30.00	50.00	100.00
RUID	*Rubus idaeus*	2.40	.50	10.00	71.43
BEOC2	*Betula occidentalis*	6.50	3.00	10.00	57.14
COST4	*Cornus stolonifera*	10.88	.50	30.00	57.14
SYOC	*Symphoricarpos occidentalis*	2.25	.50	5.00	57.14
PRVI	*Prunus virginiana*	12.50	5.00	20.00	28.57
SAEX	*Salix exigua*	3.00	3.00	3.00	28.57
Graminoids					
POPR	*Poa pratensis*	5.57	3.00	10.00	100.00
AGST2	*Agrostis stolonifera*	6.17	.50	20.00	85.71
POPA2	*Poa palustris*	2.88	.50	10.00	57.14
MURA	*Muhlenbergia racemosa*	10.00	10.00	10.00	28.57
Forbs					
RULA3	*Rudbeckia laciniata*	8.25	3.00	10.00	57.14
SOGI	*Solidago gigantea*	8.50	.50	30.00	57.14

Bepa/Quma2-Coco6
Paper birch/Bur oak-Beaked hazelnut

Table 7.--Canopy cover and constancy estimates for dominant plant species recorded in *Betula papyrifera/Quercus macrocarpa-Corylus cornuta* association, occurring in the Black Hills at an average altitude ranging from 4,500 to 5,500 ft (number = 21 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
BEPA	*Betula papyrifera*	24.56	3.00	70.00	85.71
PIGL	*Picea glauca*	12.58	.50	40.00	61.90
PIPO	*Pinus ponderosa*	5.59	.50	20.00	52.38
POTR5	*Populus tremuloides*	11.77	.50	40.00	52.38
QUMA2	*Quercus macrocarpa*	18.00	.50	50.00	66.67
Shrubs					
AMAL2	*Amelanchier alnifolia*	4.84	.50	20.00	90.48
COCO6	*Corylus cornuta*	50.48	20.00	80.00	100.00
COST4	*Cornus stolonifera*	7.28	.50	20.00	42.86
PRVI	*Prunus virginiana*	5.29	.50	10.00	80.95
ROWO	*Rosa woodsii*	4.04	.50	20.00	61.90
SABE2	*Salix bebbiana*	7.75	.50	20.00	28.57
SYAL	*Symphoricarpos albus*	8.65	.50	20.00	61.90
SYOC	*Symphoricarpos occidentalis*	2.95	.50	10.00	47.62
Graminoids					
AGST2	*Agrostis stolonifera*	1.95	.50	10.00	47.62
ORAS	*Oryzopsis asperifolia*	2.33	.50	10.00	57.14
POPR	*Poa pratensis*	5.00	.50	20.00	66.67
Forbs					
ARNU2	*Aralia nudicaulis*	7.55	.50	40.00	90.48
TORY	*Toxicodendron rydbergii*	8.77	.50	30.00	61.90
VICA4	*Viola canadensis*	2.00	.50	10.00	61.90

Sabe2/Caro6

Bebb willow/Beaked sedge

Table 8.--Canopy cover and constancy estimates for dominant plant species recorded in *Salix bebbiana/Carex rostrata* association, occurring in the Black Hills at an average altitude ranging from 5,000 to 6,200 ft (number = 17 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
PIGL	*Picea glauca*	5.83	.50	30.00	35.29
Shrubs					
COST4	*Cornus stolonifera*	4.50	.50	10.00	17.65
SABE2	*Salix bebbiana*	23.46	.50	60.00	70.59
SALU2	*Salix lutea*	2.50	2.50	2.50	5.88
SAPE5	*Salix petiolaris*	20.00	20.00	20.00	11.76
SAPL2	*Salix planifolia*	17.63	.50	30.00	23.53
SAPS	*Salix pseudomonticola*	10.00	10.00	10.00	5.88
Graminoids					
AGST2	*Agrostis stolonifera*	4.00	.50	10.00	23.53
CAAQ	*Carex aquatilis*	5.25	.50	10.00	23.53
CACA4	*Calamagrostis canadensis*	4.38	.50	20.00	47.06
CARO6	*Carex rostrata*	36.09	.50	80.00	100.00
Forbs					
ACMI2	*Achillea millefolium*	1.21	.50	3.00	41.18
LYCI	*Lysimachia ciliata*	1.20	.50	3.00	58.82
MEAR4	*Mentha arvensis*	3.60	.50	10.00	58.82

Acne2/Bepa-Popr

Box elder/Water birch-Western snowberry

Table 9.--Canopy cover and constancy estimates for dominant plant species recorded in *Acer negundo/Betula occidentalis-symphoricarpos occidentalis* association, occurring in the Black Hills at an average altitude ranging from 3,700-4,600 ft (number = 8 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
ACNE2	*Acer negundo*	14.60	3.00	20.00	62.50
FRPE	*Fraxinus pennsylvanica*	40.00	40.00	40.00	12.50
OSVI	*Ostrya virginiana*	11.50	3.00	20.00	25.00
PIGL	*Picea glauca*	3.00	3.00	3.00	12.50
SAAM2	*Salix amygdaloides*	3.00	3.00	3.00	25.00
ULAM	*Ulmus americana*	11.50	3.00	20.00	25.00
Shrubs					
BEOC2	*Betula occidentalis*	51.43	20.00	80.00	87.50
COST4	*Cornus stolonifera*	6.80	.50	20.00	62.50
PRVI	*Prunus virginiana*	2.50	.50	3.00	62.50
SYOC	*Symphoricarpos occidentalis*	11.30	.50	30.00	62.50
Graminoids					
BRIN2	*Bromus inermis*	20.00	20.00	20.00	12.50
BRPU6	*Bromus pubescens*	3.00	3.00	3.00	12.50
CAREX	*Carex*	3.29	.50	10.00	87.50
POPR	*Poa pratensis*	19.56	.50	60.00	100.00
Forbs					
TORY	*Toxicodendron rydbergii*	14.50	.50	40.00	37.50
PTAQ	*Pteridium aquilinum*	53.50	.50	80.00	37.50

Caaq/Caca4-Caro6

Aquatic sedge/Blue joint reedgrass-Beaked sedge

Table 10.--Canopy cover and constancy estimates for dominant plant species recorded in *Carex aquatilis/Calamagrostis canadensis-Carex rostrata* association, occurring in the Black Hills at an average altitude ranging from 4,200 to 5,600 ft (number = 9 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
OSVI	*Ostrya virginiana*	2.50	2.50	2.50	11.11
PIPO	*Pinus ponderosa*	2.75	2.75	2.75	11.11
Shrubs					
SABE2	*Salix bebbiana*	5.67	.50	10.00	66.67
RIBES	*Ribes*	3.67	.50	10.00	33.33
SYOC	*Symphoricarpos occidentalis*	3.67	.50	10.00	33.33
BEOC2	*Betula occidentalis*	12.50	5.00	20.00	22.22
COCO6	*Corylus cornuta*	2.75	.50	5.00	22.22
Graminoids					
CAAQ	*Carex aquatilis*	19.28	.50	70.00	100.00
CACA4	*Calamagrostis canadensis*	23.25	.50	90.00	88.89
CARO6	*Carex rostrata*	11.33	3.00	20.00	66.67
SCMI2	*Scirpus microcarpus*	4.50	.50	20.00	66.67
POPA2	*Poa palustris*	11.20	.50	30.00	55.56
POPR	*Poa pratensis*	2.25	.50	5.00	44.44
Forbs					
CIAR4	*Cirsium arvense*	.83	.50	2.50	66.67
CIMA2	*Cicuta maculata*	.83	.50	2.50	66.67
MEAR4	*Mentha arvensis*	5.25	.50	15.00	88.89

Carex spp.
Sedges

Table 11.--Canopy cover and constancy estimates for dominant plant species recorded in *Carex spp. (Undefined)* association, occurring in the Black Hills at an average altitude ranging from 3,900 to 4,900 ft (number = 10 stands).

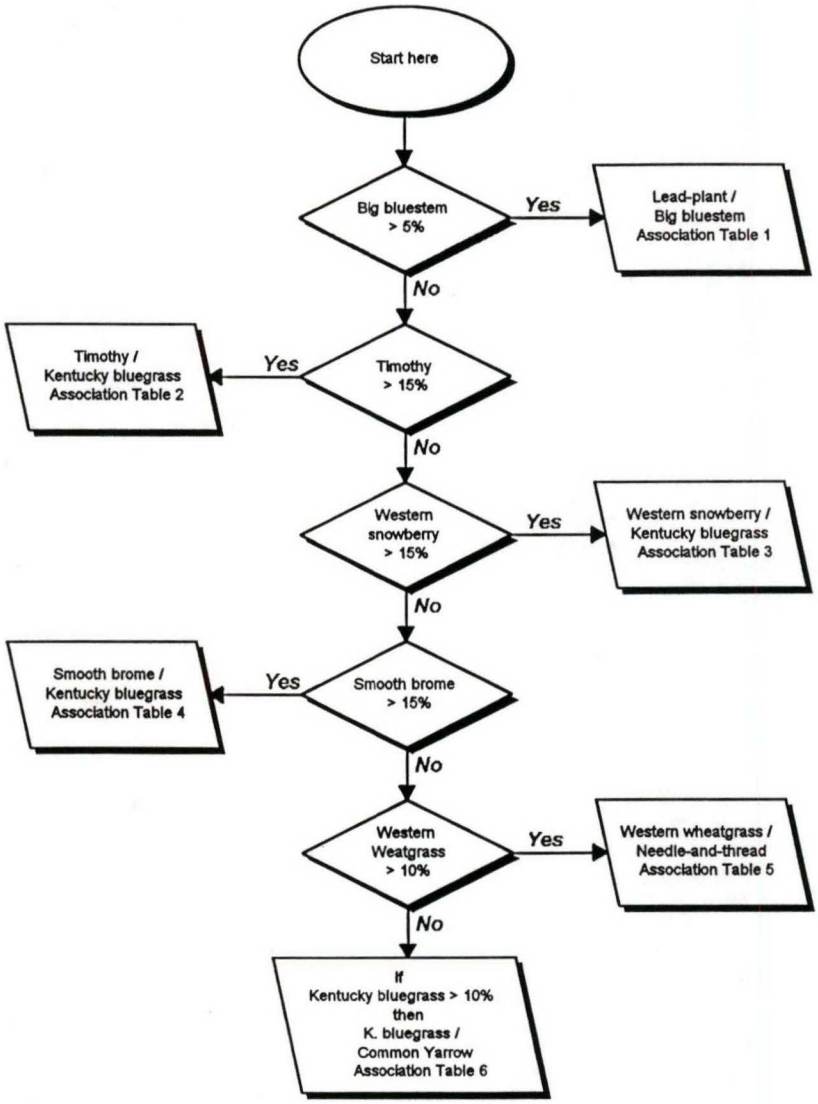
		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
QUMA2	*Quercus macrocarpa*	15.13	.50	30.00	40.00
Shrubs					
COST4	*Cornus stolonifera*	2.38	.50	3.00	40.00
PAQU2	*Parthenocissus quinquefolia*	1.13	.50	3.00	40.00
ROWO	*Rosa woodsii*	1.50	.50	3.00	50.00
RUID	*Rubus idaeus*	1.00	.50	3.00	50.00
SABE2	*Salix bebbiana*	2.40	.50	10.00	50.00
SYAL	*Symphoricarpos albus*	3.50	.50	10.00	40.00
Graminoids					
AGST2	*Agrostis stolonifera*	1.13	.50	3.00	40.00
BRIN2	*Bromus inermis*	2.38	.50	3.00	40.00
CACA4	*Calamagrostis canadensis*	8.38	.50	20.00	40.00
CAREX	*Carex*	25.00	10.00	50.00	100.00
POPR	*Poa pratensis*	3.29	.50	10.00	70.00
EQAR	*Equisetum arvense*	2.88	.50	10.00	40.00
EQLA	*Equisetum laevigatum*	1.13	.50	3.00	40.00
Forbs					
RUHI2	*Rudbeckia hirta*	1.13	.50	3.00	40.00
THDA	*Thalictrum dasycarpum*	2.38	.50	3.00	40.00
THVE	*Thalictrum venulosum*	1.13	.50	3.00	40.00
TORY	*Toxicodendron rydbergii*	17.20	3.00	50.00	50.00
VIOLA	*Viola*	1.13	.50	3.00	40.00

This association is not in the key diagram because Carex spp. Was not identified in the data.

Black Hills Non-Forested Upland Plant Associations

Code		Number of sites
Syoc/Popr	*Symphoricarpus occidentalis/Poa pratensis* Western snowberry/Kentucky bluegrass	*14*
Agsm/stco4	*Agropyron smithii/Stipa comata* Western wheatgrass/Nedle-and-thread	*28*
Amca6/Ange	*Amorpha canescens/Andropogon gerardii* Lead plant/Big bluestem	*6*
Brin2/Popr	*Bromus inermis/Poa pratensis* Smooth brome/Kentucky bluegrass	*11*
Phpr3/Popr	*Phleum pratense/Poa pratensis* Timothy/Kentucky bluegrass	*6*
Popr/Acmi2	*Poa pratensis/Achillea mellifolium* Kentucky bluegrass/common yarrow	*26*

Black Hills Non-Forested Upland Vegetation Classification Key



Amca/Ange

Lead-plant/Big bluestem

Table 1.--Canopy cover and constancy estimates for dominant plant species recorded in *Amorpha canescens/Andropogon gerardii* association, occurring in the Black Hills (number = 5 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Shrubs					
AMCA6	*Amorpha canescens*	5.40	.50	20.00	100.00
ARFR4	*Artemisia frigida*	1.75	.50	3.00	40.00
PRVI	*Prunus virginiana*	3.00	3.00	3.00	20.00
SYOC	*Symphoricarpos occidentalis*	2.17	.50	3.00	60.00
Graminoids					
AGSM	*Agropyron smithii*	3.00	3.00	3.00	20.00
ANGE	*Andropogon gerardii*	16.00	10.00	30.00	100.00
BOCU	*Bouteloua curtipendula*	3.00	3.00	3.00	20.00
BOGR2	*Bouteloua gracilis*	3.00	3.00	3.00	20.00
BRJA	*Bromus japonicus*	20.00	10.00	30.00	40.00
POPR	*Poa pratensis*	20.75	3.00	30.00	80.00
Forbs					
ARLU	*Artemisia ludoviciana*	4.50	.50	10.00	60.00
ROAR3	*Rosa arkansana*	2.17	.50	3.00	60.00

Phpr/Popr

Timothy/Kentucky bluegrass

Table 2.--Canopy cover and constancy estimates for dominant plant species recorded in *Phleum pratense/Poa pratensis* association, occurring in the Black Hills (number = 6 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Graminoids					
BRIN2	*Bromus inermis*	5.00	.00	20.00	33.33
BRMA4	*Bromus marginatus*	1.67	.00	10.00	16.67
CAST5	*Carex stipata*	1.67	.00	10.00	16.67
PHPR3	*Phleum pratense*	35.00	20.00	50.00	100.00
POPR	*Poa pratensis*	10.00	.00	20.00	66.67
Forbs					
ACMI2	*Achillea millefolium*	2.92	.50	10.00	100.00
CIUN	*Cirsium undulatum*	1.00	.00	3.00	33.33
ERSU2	*Erigeron subtrinervis*	1.83	.00	10.00	50.00
MOFI	*Monarda fistulosa*	1.83	.00	10.00	50.00
POGR9	*Potentilla gracilis*	3.58	.00	20.00	66.67
TAOF	*Taraxacum officinale*	1.75	.00	10.00	33.33
TRPR2	*Trifolium pratense*	2.83	.00	10.00	83.33

Syoc/Popr

Western snowberry/Kentucky bluegrass

Table 3.--Canopy cover and constancy estimates for dominant plant species recorded in *Symphoricarpos occidentalis/Poa pratensis* association, occurring in the Black Hills (number = 14 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
PIPO	*Pinus ponderosa*	6.50	3.00	10.00	14.29
POTR5	*Populus tremuloides*	5.25	.50	10.00	14.29
Shrubs					
SYOC	*Symphoricarpos occidentalis*	22.14	20.00	30.00	100.00
Graminoids					
POPR	*Poa pratensis*	16.86	3.00	30.00	100.00
AGSM	*Agropyron smithii*	6.63	.50	20.00	28.57
AGST2	*Agrostis stolonifera*	3.50	.50	10.00	28.57
CAREX	*Carex*	4.13	.50	10.00	28.57
Forbs					
MOFI	*Monarda fistulosa*	4.40	.50	20.00	71.43
GEVI2	*Geranium viscosissimum*	5.30	.50	10.00	35.71
SOCA6	*Solidago canadensis*	6.00	.50	20.00	28.57
CIUN	*Cirsium undulatum*	7.00	.50	20.00	21.43

Brin/Popr

Smooth brome/Kentucky bluegrass

Table 4.--Canopy cover and constancy estimates for dominant plant species recorded in *Bromus inermis/Poa pratensis* association, occurring in the Black Hills (number = 11 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Graminoids					
BRIN2	*Bromus inermis*	27.27	20.00	50.00	100.00
CAREX	*Carex*	7.67	3.00	10.00	27.27
PHPR3	*Phleum pratense*	2.92	.50	10.00	54.55
POPR	*Poa pratensis*	14.23	.50	30.00	100.00
Forbs					
ACMI2	*Achillea millefolium*	3.15	.50	10.00	90.91
CARO2	*Campanula rotundifolia*	2.08	.50	10.00	54.55
MOFI	*Monarda fistulosa*	6.50	3.00	10.00	36.36
TRHY	*Trifolium hybridum*	3.00	3.00	3.00	36.36

Agsm/Stco

Western wheatgrass/Needle-and-thread

Table 5.--Canopy cover and constancy estimates for dominant plant species recorded in *Agropyron smithii/Stipa comata* association, occurring in the Black Hills (number = 28 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Shrubs					
ARFR4	*Artemisia frigida*	5.67	.50	20.00	75.00
ROWO	*Rosa woodsii*	2.50	.50	10.00	21.43
Graminoids					
AGSM	*Agropyron smithii*	14.65	.50	30.00	71.43
BOGR2	*Bouteloua gracilis*	6.71	.50	20.00	25.00
BRJA	*Bromus japonicus*	9.82	.50	30.00	39.29
BRTE	*Bromus tectorum*	13.86	.50	70.00	25.00
CAFI	*Carex filifolia*	10.25	.50	20.00	14.29
CAREX	*Carex*	15.08	.50	30.00	21.43
KOPY	*Koeleria pyramidata*	9.50	.50	30.00	35.71
STCO4	*Stipa comata*	12.41	.50	30.00	39.29
STVI4	*Stipa viridula*	9.82	.50	40.00	39.29
Forbs					
ARDR4	*Artemisia dracunculu*	5.66	.50	20.00	16.07
LAOB2	*Lactuca oblongifolia*	3.67	.50	10.00	10.71
PSAR2	*Psoralea argophylla*	2.63	.50	10.00	28.57
TAOF	*Taraxacum officinale*	2.00	.50	10.00	28.57

Popr/Acmi

Kentucky bluegrass/Common yarrow

Table 6.--Canopy cover and constancy estimates for dominant plant species recorded in *Poa pratensis/Achillea millefolium* association, occurring in the Black Hills (number = 26 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
POTR5	*Populus tremuloides*	3.50	.50	10.00	15.38
Graminoids					
POPR	*Poa pratensis*	21.40	.50	50.00	100.00
STVI4	*Stipa viridula*	2.61	.50	10.00	34.62
KOPY	*Koeleria pyramidata*	3.81	.50	10.00	30.77
PHPR3	*Phleum pratense*	2.63	.50	10.00	30.77
AGSM	*Agropyron smithii*	2.57	.50	10.00	26.92
BRIN2	*Bromus inermis*	8.60	3.00	10.00	19.23
AGST2	*Agrostis stolonifera*	5.25	.50	10.00	15.38
Forbs					
ACMI2	*Achillea millefolium*	2.11	.50	10.00	88.46
CEAR4	*Cerastium arvense*	3.73	.50	20.00	57.69
POGR9	*Potentilla gracilis*	2.77	.50	10.00	57.69

Pipo/Potr

Ponderosa pine/Quaking aspen

(This type was deleted from the key because of the new Title "Non-forested uplands")

Table 7.--Canopy cover and constancy estimates for dominant plant species recorded in *Pinus ponderosa/Populus tremuloides* association, occurring in the Black Hills (number = 4 stands).

		Canopy Cover (%)			
		Mean	Min	Max	Cons
Trees					
BEPA	*Betula papyrifera*	3.00	3.00	3.00	25.00
PIPO	*Pinus ponderosa*	6.00	.50	20.00	100.00
POTR5	*Populus tremuloides*	5.88	.50	10.00	100.00
Shrubs					
PRVI	*Prunus virginiana*	20.00	20.00	20.00	25.00
SYOC	*Symphoricarpos occidentalis*	3.50	.50	10.00	100.00
Graminoids					
AGRE2	*Agropyron repens*	10.00	10.00	10.00	25.00
AGTR	*Agropyron trachycaulum*	10.00	10.00	10.00	25.00
CAPR5	*Carex praegracilis*	10.00	10.00	10.00	25.00
ORAS	*Oryzopsis asperifolia*	1.75	.50	3.00	50.00
POPR	*Poa pratensis*	1.75	.50	3.00	50.00
Forbs					
MOFI	*Monarda fistulosa*	2.17	.50	3.00	75.00
SMST	*Smilacina stellata*	6.00	.50	20.00	100.00